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Survey of software tools for energy efficiency in a community☆

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A R T I C L E   I N F O

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A B S T R A C T

The aim of this work is to present practical tools to analyze energy, economic and environmental performances of energy generation systems, buildings and equipments in a community. The models and software tools presented are very different to each other and are designed to support different phases in an efficient community project implementation.

Contents

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1. Introduction

This section describes the models and practical tools useful in planning and implementation of distributed generation systems to scale district/city and tools to analyze energy, economic and environmental performances of energy generation systems, buildings and equipments in a community. The different tools were classified according to the aims and achievements in several categories:

- models "Geography" for the assessment of availability of renewable energy locally available, distribution and morphology of the built environment, location facilities and infrastructure for the dynamic representation of data and results
- models "energy" for the construction of the demand curve for the different energy consumers for the generation of distributed generation scenarios belonging to different technological mixes
- models of evaluation, for analysis of other aspects of power generation (Assessment of environmental effects, life cycle analysis, introduction of aspects economic and social, etc.).

2. Geography models

2.1. ARCGIS [1]

2.1.1. Authors/Developers: ESRI

It is an integrated collection of GIS software products for building and deploying a complete geographical information system to perform spatial analysis, manage large amounts of data and produce cartographically appealing maps to support decision making process.

Input: Geographic maps and related data.

Output: Spatial analysis and processing of data.

2.2. Raster Cities [2]

2.2.1. Authors/Developers: SENSEable City Laboratory, MIT

Raster Cities represents a new paradigm for assessing the environment consequences of urban texture. This new approach is based on the use of simple raster models of cities, called Digital Elevation Models (DEMs). Using software algorithms derived from image processing it is possible to develop efficient methods of measuring geometric parameters and assessing radiation exchange, energy consumption, wind porosity, etc. Results are extremely fast and accurate; due to the increasing availability of DEMs from lidar, they could open the way to new raster-based urban models for planning and design.

This is centred on the relationship existing between environmental indicators and urban morphology: the question is if – and in what measure – the correct arrangement and the shape of the urban fabric alone might improve the environmental behavior of the city. With the aim of creating effective environmental quality starting just from morphology, several design tools can be developed, assessing new potentialities related to the form of human settlements. For instance, the energy-based morphogenesis of the built environment could be intended as the first step towards the improvement of the sustainability of cities with no additional cost due to the application of complex technologies.

The tools reveal themselves to be a feasible way to assess the environmental quality of urban spaces. Under the broad definition of environmental quality, aspects related to both energy efficiency and human comfort are taken into account: on the one hand, the aim is to quantify the potential energy efficiency derived from the capacity of the urban fabric to take advantage of passive gains at the city scale; on the other hand, aspects of perceived comfort in urban open spaces are investigated, among others or through visual preference analyses, through the definition of thermal conditions. Environmental parameters include solar access (solar paths, mean shadow density, solar gain through solar envelopes, sky-view factors), energy consumption (surface-to-volume ratio and passive/non-passive zones), cross-ventilation, wind porosity, urban canyon height-to-width, pedestrian accessibility and visual perception of open spaces through isovist fields.

Input: Digital Elevation Model namely images raster of the woven urban together to the coordinated geographic and specify them climatic locality.

Output: Calculation and display two- and three-dimensional geographical data sunlight of the urban fabric. The tool is flexible and allows to compute the contributions of radiation and

potential electricity to individual buildings or city blocks, or distinguish between the production of energy from vertical surfaces and horizontal differ in orientation.

3. Energy models

3.1. HOMER [3]

3.1.1. Authors/Developers: NREL, National Renewable Energy Laboratory, USA

Computer model that simplifies the task of evaluating design options for both off-grid and grid-connected power systems for remote, stand-alone, and distributed generation (DG) applications. HOMER's optimization and sensitivity analysis algorithms is used to evaluate the economic and technical feasibility of a large number of technology options and to account for variation in technology costs and energy resource availability. Power sources that can be modelled include: solar photovoltaics (PV), wind turbines, run-of-river hydro power, diesel, gasoline, biogas, alternative, co-fired and custom-fueled generators, electric utility grids, microturbines, and fuel cells. Storage options include: battery banks and hydrogen.

Up to 1 min time-step analysis, optimization-sensitivity parametric analysis. Two options to meet electrical energy demand: load following and cycle charging (storage options).

Input: Load curve (electrical, thermal) up to 1 min resolution, technology efficiencies and features, O&M costs, emission constraints and sensitivity parameters.

Output: Optimization and sensitivity analysis of the system involving energy production, fuel consumption, emissions and costs with graphs and detailed data report (export format .xml/.html).

3.2. RETScreen [4]

3.2.1. Authors/Developers: RETScreen International, CANADA

RETScreen International Clean Energy Project Analysis Software can be used world-wide to evaluate the energy production, life-cycle costs and greenhouse gas emission reductions for various types of energy efficient and renewable energy technologies (RETs). The software also includes product, cost and weather databases, and a detailed online user manual. The RETScreen International Online Product Database provides users access to contact information for more than 1000 clean energy technology manufacturers around the globe, including direct Website and Internet links from within the RETScreen software and from the Website (Marketplace). In addition, the database provides access to pertinent product performance and specifications data for a number of these manufacturers. These data can be "pasted" to the relevant cells within the RETScreen software. The RETScreen software currently includes modules for evaluating: wind energy, small hydro, solar photovoltaics (PVs), combined heat and power, biomass heating, solar air heating, solar water heating, passive solar heating, ground-source heat pumps, and refrigeration.

Excel based spreadsheets, sensitivity parametric analysis, risk analysis.

Evaluate the techno-economic feasibility of a local single clean energy technologies application.

Input: Weather data, resources availability, technology efficiencies and features, O&M costs, emission constraints and sensitivity parameters (several informations are provided in the software database).

Output: Energy production, life cycle cost, emissions, load curve, risk analysis, data export in .xls format.

3.3. HYDROGEMS, Hydrogen Energy Models [5]

3.3.1. Authors/Developers: Institute for Energy Technology IFE, Norway

Library of models for simulating integrated hydrogen systems based on renewable energy. The HYDROGEMS library includes models for power producing equipment, such as photovoltaic (PV) generators, wind energy conversion systems (WECS), diesel engine generator systems (DEGS), proton exchange membrane fuel cells (PEMFC), and alkaline fuel cells (AFC). Models for water electrolysis and H2-storage are also included, along with models for lead-acid battery, power conditioning equipment and logical controls. The models have been designed to be as general as possible, so that specific components characteristics obtained from manufacturers, or from experiments, readily can be added to a database. In general, component specific parameters, such as those describing current–voltage characteristics (*IV*-curves) of PV, are calculated from manufacturer's data, while design parameters, such as number of cells in series and/or parallel, are set inside a simulation assembly. The HYDROGEMS components are written as FORTRAN subroutines and are primarily designed to run within the simulation environment TRNSYS and EES.

Dynamic simulation of H2RES hybrid systems.

Input: Detailed parameters and features of hybrid energy system components, weather data, load data.

Output: Detailed data and graphs about energy production and operating parameters of the hybrid system.

3.4. LEAP, Long Range Energy Alternatives Planning [6]

3.4.1. Authors/Developers: Stockholm Environment Institute (SEI)

LEAP is a comprehensive integrated scenario-based energy-environment modelling tool. Its scenarios account for how energy is consumed, converted and produced in a given energy system under a range of alternative assumptions on population, economic development, technology, price and so on. LEAP is primarily an accounting system but users can also build econometric and simulation-based models. It supports both final and useful energy demand analyses as well as detailed stockturnover modelling for transportation and other analyses. On the supply side it supports a range of simulation methods for modelling both capacity expansion and plant dispatch. LEAP includes a Technology and Environmental Database (TED) containing data on the costs, performance and emission factors for over 1000 energy technologies. It can be used to calculate the emissions profiles and to create scenarios of non-energy sector emissions and sinks (e.g. cement production, land-use change, solid waste, etc.).

Physical accounting, sensitivity parametric analysis.

Different energy scenario evaluations, integrated Energy/Environment Analysis.

Input: Load–duration curve (electrical, thermal), energy sources availability data, technology efficiencies and features, O&M costs, GDP, interest rate, population growth rate, emission constraints. Examples of input data are provided in the software technology database.

Output: Detailed report and graphs about selected energy scenario.

3.5. EnergyPLAN [7]

3.5.1. Authors/Developers: Dep. of Development and Planning, Aalborg University, Denmark

The EnergyPLAN model is a computer model for Energy System Analysis. The model has been developed and expanded on a

continuous basis since 1999. The analysis is carried out in hour-by-hour steps and the consequences of each strategy with EnergyPLAN, it is possible to analyze the consequences of different energy investments and design suitable energy planning strategies in relation to technical regulation and economic optimization. The model can be used for different kinds of energy system analysis: technical analysis, market exchange analysis, feasibility studies.

One hour time-step analysis, optimization-sensitivity parametric analysis. Four options to meet electrical/thermal energy demand with different types of technical optimization and market optimization.

Evaluate the techno-economic feasibility of a large scale distributed generation project under constraints.

Input: Load curve (electrical, thermal) with 1 h resolution, weather data and energy sources availability data, technology efficiencies and features, O&M costs, emission constraints and optimization strategy (different types of technical optimization and market optimization). Examples of input data are provided in the software database in .txt format.

Output: Report and graphs about energy production, costs, emissions, data export in .txt format.

3.6. *EnergyPlus [8]*

3.6.1. *Authors/Developers: US DOE*

EnergyPlus is an energy analysis and thermal loads simulation program that has its roots in the two U.S. simulation software DOE-2 and BLAST, produced respectively by the U.S. Department of Energy and the U.S. Department of Defence.

The main feature of the program is that it is a simulator that fully couples building envelope, systems and plants, since the information on the load that the system is actually able to balance is used to determine the indoor air temperature, according to an iterative process. In this integrated approach, system and plant output directly impact the building thermal response, thus allowing a more accurate investigation of air temperature fluctuations and of the thermal comfort, that can be assessed by means of the most common parameters (such as Fanger PMV, Pierce TSV, Standard Effective Temperature ET, Corrected Effective Temperature ET*).

In fact, in EnergyPlus a time step for the analysis of the interaction between thermal zones and the exterior environment as well as a time step for the analysis of the interaction between the indoor air and the air conditioning systems and plants can be defined. These two time step may differ, thus responding to the needs of a more realistic modelling of systems control and operation.

The main simulation engine of the program consists of two basic modules, the *heat and mass balance simulation engine* that solves the balance through the simultaneous simulation of radiant and convective heat flows, and the *building system simulation engine* for the simulation of systems and plants components. These two main modules interact with all the secondary modules (for example, as regards the heat and mass balance, those that determine the position of the sun, the shading coefficients, the properties of transparent components, the heat conduction flow transmitted through the walls, the heat balance on the wall surface, etc.).

Input file and output files are ASCII text files; for the creation of the input file an editor is available. Some of the output files are converted by the software into CSV (comma separated value) files readable in a common spreadsheet.

Input:

- Efficiencies.
- One year hourly loads profiles.
- Representative days hourly load profiles.
- Weather data.

Output:

- Primary energy.
- Pollutants emissions.
- Financial indicators.

3.7. *DER-CAM Distributed Energy Resource Customer Adoption Models [9]*

3.7.1. *Authors/Developers: Distributed Energy Resources, Berkeley Lab*

DER-CAM is an economic model of customer DER adoption implemented in the General Algebraic Modelling System (GAMS) optimization software. The objective of the model is to minimize the cost of operating on-site generation and combined heat and power (CHP) systems, either for individual customer sites or a micro-grid:

- Which is the lowest-cost combination of distributed generation technologies that a specific customer can install?
- What is the appropriate level of installed capacity of these technologies that minimizes cost?
- How should the installed capacity be operated so as to minimize the total customer energy bill?

It is assumed that the customer desires to install distributed generation to minimize the cost of energy consumed on site. Consequently, it should be possible to determine the technologies and capacity the customer is likely to install and to predict when the customer will be self-generating electricity and/or transacting with the power grid, and likewise when purchasing fuel or using recovered heat.

Optimization analysis through linear programming.

Evaluate techno-economic feasibility and dispatch optimization of distributed generation systems.

Input: Load curve (electrical, thermal) with 1 h resolution, technology efficiencies and features, electric energy tariffs, natural gas price, initial investment capital, operation and maintenance costs, investment rate of interest.

Output: Optimal plant size, dispatch strategy and cost of produced energy (thermal and electrical).

3.8. *DEECO [10]*

3.8.1. *Authors/Developers: Institut für Energietechnik, Technische Universität Berlin, Germany*

DEECO is an energy systems modelling environment which is used to define, guide, and evaluate sustainability improvements of all types, typical goals include less CO_2 and reduced fossil fuel dependence. It can be used to test a number of potential improvements and will naturally include any synergetic or counteractive interactions which arise, hence the term "integration modelling". Improvements can be classified as hard, for instance, enhanced plant performance or revised connectivity, or soft, such as targeted demand modification or amended operational policy. DEECO represents a given system as a network of dynamic plant whose state may evolve. DEECO determines best-practice operation as defined by the selected management objective, using recursive dynamic optimization techniques. Analysis proceeds by comparison with some pre-determined reference case. DEECO is normally used to compute sustainability gains versus financial cost relative to some assessment of business-as-usual.

One hour time-step analysis, optimization-sensitivity parametric analysis. Various options to meet electrical/thermal energy demand with different types of technical optimization and market optimization.

Evaluate the techno-economic feasibility of a large scale distributed generation system project under constraints, investigating possible options and optimization. Energy analysis/Exergy analysis.

Input: Load curve (electrical, thermal), 1 h resolution, weather data and energy sources availability data, technology efficiencies and features, O&M costs, emission constraints and optimization strategy (different types of technical optimization and market optimization).

Output: Detailed report and graphs about energy/exergy, costs, emissions, data export in .xml format.

3.9. Hybrid2 [11]

3.9.1. Authors/Developers: NREL, University of Massachusetts

Hybrid2 is a combined probabilistic/time series computer model that assists a designer in sizing hybrid power systems and in selecting operating options on the basis of overall system performance and economics when site specific conditions and load profiles are known. Hybrid2 allows the user to easily consider a number of system configurations and operating strategies to optimize the system design. The simulation models for hybrid power systems can be classified into two broad categories: logistical models and dynamic models. *Logistical models* are used primarily for long-term performance predictions, for component sizing, and for providing input to economic analyses. *Dynamic models* are used primarily for component design, assessment of system stability, and determination of power quality. Hybrid2 is a logistical model, since it allows the user to determine long-term system performance while taking into consideration the effect of the short-term variability of the renewable resources. Hybrid2 is based on a combined time series and statistical approach. More specifically, Hybrid2 uses a time series approach to account for load and resource variations over intervals typically ranging from 10 min to 1 h. Shorter term fluctuations within those intervals are dealt with by means of statistical techniques.

Input: The Hybrid2 inputs are split into the following categories:

1 *Loads:* primary, deferrable, optional and heating load.
2 *Site/resource:* site parameters as well as time series data of wind, insolation and ambient temperature.
3 *Power system:* It is based on a three-bus grid that includes an AC, DC, and shaft bus system. Specific types of components are then included in each subsystem that is attached to one of the buses. Components include wind turbine, PV module, diesel, dump load, battery, converter, synchronous condenser and dispatch strategy.
4 *Base case:* for comparison purposes, the user can supply the primary and deferrable loads using a diesel-only system. The technical and economic performance of a system with renewable can be compared to those of the diesel-only system.
5 *Economics:* costs of the various components as well as economic parameters that are used to evaluate the economic performance of the system.

Output: Hybrid2 provides three kinds of output:

1. *Performance summary files:* summary of the cumulative energy flows and fuel consumption during the simulation run.
2. *Economics summary file:* net present value of total costs, levelized cost of energy, simple payback period, discounted payback period, internal rate of return, yearly cash flows, etc.
3. *Detailed files:* they include values of a number of system variables for each time step. Examples of system variables include the power going to each type of load, the unmet load, the power produced by each generating unit, the power going into storage, the power conversion losses, the hybrid system diesel fuel consumption, the base case system diesel fuel consumption, and the time step energy balance.

3.10. TrnSys [12]

3.10.1. Authors/Developers: Solar Energy Laboratory, University of Wisconsin

TRNSYS (pronounced tran-sis) is a modular simulation program that was designed to solve complex energy system problems by breaking the problem down into a series of smaller components. TRNSYS components (referred to as “Types”) may be as simple as a pump or pipe, or as complicated as a multi-zone building model. The components are configured and assembled using a fully integrated visual interface known as the *TRNSYS Simulation Studio*, and building input data is entered through a dedicated visual interface (*TRNBuild*). The simulation engine then solves the system of algebraic and differential equations that represent the whole system.

In addition to a *detailed multizone building model*, the TRNSYS library includes components for *solar thermal and photovoltaic systems, low energy buildings and HVAC systems, renewable energy systems, cogeneration, fuel cells and hydrogen systems*, etc. The modular nature of TRNSYS facilitates the addition of new mathematical models to the program. In addition to the ability to develop new components in any programming language, the program allows users to directly embed components created using other software (e.g. Matlab/Simulink, Excel/VBA, and EES). TRNSYS can also generate executables that allow a non-expert to run parametric studies.

Input: The TRNSYS input file, including building input description, characteristics of system components and manner in which components are interconnected, and separate weather data (supplied with program) are all ASCII files. All input files can be generated by using a graphical user interface, known as the Simulation Studio.

Output: Basic output format is ASCII. The data included in those files can be life cycle costs; monthly summaries; annual results; histograms; plotting of desired variables (by time unit). It is also possible to plot variables online (as the simulation progresses).

4. Evaluation models

4.1. PLACE3S Planning for Community Energy, Economic and Environmental Sustainability [13]

4.1.1. Authors/Developers: California energy commission

PLACE3S is an innovative planning method that integrates public participation, community development and spatial analysis within a geographical information system framework. The aim of this model is to help public administrations creating local economic development, job opportunity, reducing at the same time environmental impact and fossil resources use; in particular a great importance in the model is given to mobility and suburban sprawl problem. It is fundamental to support, with the help of adequate tools, implementation process through a step by step results monitoring and, for this reason, a GIS tool is fundamental. Sustainable energy use and environmental impact mitigation are key factors in advanced community planning and poses several problems: reduction of traffic congestion, improvement in air quality and environmental quality in the built environment, reduction of costs for infrastructures, preservation of landscape and wildlife, promotion of local economic development and job opportunity.

Evaluate possible scenarios for energy efficient community implementation. The methodology and procedure can be taken as

a benchmark for planning processes that assume energy efficiency and renewable energy as key factors.

Input: Demography data, industrial, residential and tertiary energy consumption data, employment statistics, building's technical specifications, infrastructures lay-out, pollution data, meteorological data.

Output: Scenarios of energy consumption evolution in a community, environmental conditions, infrastructures, industrial, residential and commercial sites location and lay-out.

5. Clean energy analysis tools

5.1. Portfolio Manager [14]

5.1.1. Authors/Developers: ENERGY STAR – EPA

Enables states to rate their facilities' energy performance and identify priority opportunities. Assists states in applying for the ENERGY STAR label for facilities scoring 75 or higher.

Input:

- Facility space type.
- Meter information.
- Energy type.
- Energy use.

Output:

- ENERGY STAR energy performance rating (1–100).
- Portfolio profile, including information on status, progress, financials, performance, environment, and energy intensity.

5.2. Target Finder [15]

5.2.1. Authors/Developers: ENERGY STAR – EPA

Allows states to assess the design of new buildings and compare simulations with existing buildings, based on data provided. Helps set energy performance goals and receive an energy rating for design projects.

Input:

- Facility location, type, size, occupancy, number of computers, and operating hours per week.
- Energy target rating or energy reduction target, energy source, estimated energy usage, and energy rate.

Output:

- Projected ENERGY STAR energy performance rating (1–100).
- Projected energy reduction (%) (from an average building).
- Projected energy use intensity.
- Projected annual source energy use.
- Projected site energy use.
- Projected energy costs.

5.3. Small Business Calculator [16]

5.3.1. Authors/Developers: ENERGY STAR – EPA

Estimates a facility's energy intensity and potential energy cost savings from upgrades.

Input:

- Facility size.
- Facility type.
- Previous 12 months energy bill figures.

Output:

- Energy intensity (energy used per square foot).
- Potential cost savings from energy efficiency upgrades.

5.4. Life-Cycle Cost Program [17]

5.4.1. Authors/Developers: National Institute of Standards/Technology (NIST)

Enables states to evaluate alternative designs that may have higher initial costs, using a life-cycle costing method.

Input:

- Initial and contract costs.
- Base-year energy costs.
- Maintenance and repair costs.
- Time period.
- Emissions inputs.

Output:

- Costs and benefits of energy and water conservation and renewable energy projects.
- Economic analyses (net savings, savings-to-investment ratio, rate of return, payback period).

5.5. Clean Air and Climate Protection Software [18]

5.5.1. Authors/Developers: National Association of Clean Air Agencies

Tracks emission reductions and forecasts emissions from proposed reduction measures. Develops government baseline inventory.

Input:

- Fuel and energy use by type of source (e.g., coal, solar, wind).
- Sector information.
- Emissions factors (default provided).

Output:

- Equivalent GHG emissions from fuel and electricity use, presented in reports outlined by sector, by location, by source, or by indicator.

5.6. Greenhouse Gas Equivalencies Calculator [19]

5.6.1. Authors/Developers: EPA

Translates GHG reductions into terms that are easier to conceptualize. States can also use the calculator "in reverse."

Input:

- Quantity of emission reductions (e.g., metric tons of CO_2 equivalent).

Output:

- Gallons of gasoline not consumed.
- kWh of electricity not consumed.
- Number of cars and light trucks not driven in one year.

5.7. e-GRID [20]

5.7.1. Authors/Developers: EPA

Allows states to obtain information on power plants. Develop emissions inventories for buildings.

Input:

- Year of data.
- Plant(s) or state(s) of interest.

Output:

- NOx, SO_2, CO_2, and mercury, with emissions reported in tons, input and output rates.
- Generation resources mix, in MWh and percentage.

5.8. State Inventory Tool [21]

5.8.1. Authors/Developers: EPA

Enables states to develop GHG emissions inventories.

Input: State-specific data (pre-loaded default data used otherwise).

Output: Comprehensive GHG emissions inventory covering multiple industry sources.

5.9. Emissions Forecasting Tool [21]

5.9.1. Authors/Developers: EPA

Enables states to forecast business-as-usual emissions through 2020.

Input: State assumptions relating to future growth and consumption patterns.

Output: Estimation of future emissions through linear extrapolation of State Inventory Tool output and federal forecasts.

5.10. Community Energy Opportunity Finder [22]

5.10.1. Authors/Developers: Rocky Mountain Institute

Helps identify potential community benefits resulting from energy efficiency upgrades and renewable energy opportunities.

Input:

- Community and building characteristics.
- Building energy consumption.
- Energy costs.
- Emissions data.

Output:

- Energy savings.
- Dollar savings.
- Reductions in CO_2, NOx, and SO_2 emissions.
- Job creation.

5.11. Cash Flow Opportunity Calculator [23]

5.11.1. Authors/Developers: ENERGY STAR – EPA

Calculates the amount of equipment that can be purchased using anticipated savings. Compares costs of financing and waiting for cash.

Input:

- Facility size.
- Energy costs and savings target.
- Financing rate and term.
- % savings to be committed to upgrades.

Output:

- Suggested spending on energy efficiency ($/ft2).
- Potential lost savings due to waiting one year to avoid financing.
- Potential cost of waiting for better interest rate.

6. Conclusion

From this survey it is evident that there is a wide range of different energy tools available which are diverse in terms of the regions they analyze, the technologies they consider, and the objectives they fulfil. It is worth mentioning at this point that although the typical application of each tool has been outlined briefly here, it is also imperative to consider numerous other factors when choosing an energy tool.

References

[1] http://www.esri.com/software/arcgis/.
[2] http://senseable.mit.edu/raster/.
[3] http://www.nrel.gov/homer.
[4] http://www.retscreen.net.
[5] http://www.hydrogems.no/.
[6] http://www.energycommunity.org.
[7] http://energy.plan.aau.dk/.
[8] http://www.energyplus.gov/.
[9] http://der.lbl.gov/dercam.html.
[10] http://www.iet.tu-berlin.de/deeco/.
[11] http://www.ceere.org/rerl/projects/software/hybrid2/documentation.html.
[12] http://sel.me.wisc.edu/trnsys.
[13] http://www.energy.ca.gov/places/.
[14] http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.
[15] http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder.
[16] http://www.energystar.gov/index.cfm?c=small_business.sb_calculate.
[17] http://www1.eere.energy.gov/femp/information/download_blcc.html.
[18] http://www.cacpsoftware.org/.
[19] http://www.epa.gov/cleanenergy/energy-resources/calculator.html.
[20] http://www.epa.gov/cleanenergy/egrid/index.htm.
[21] http://www.epa.gov/climatechange/wycd/stateandlocalgov/analyticaltools.html.
[22] http://www.energyfinder.org/.
[23] http://www.energystar.gov/ia/business/cfo_calculator.xls.